4-WIRE FOREIGN EXCHANGE SUBSCRIBER WITH VF RESPONSE EQUALIZER (4WFXS/VF) CHANNEL UNIT, 628240, AND 4-WIRE FOREIGN EXCHANGE SUBSCRIBER (4WFXS) CHANNEL UNIT, 628245

GENERAL DESCRIPTION

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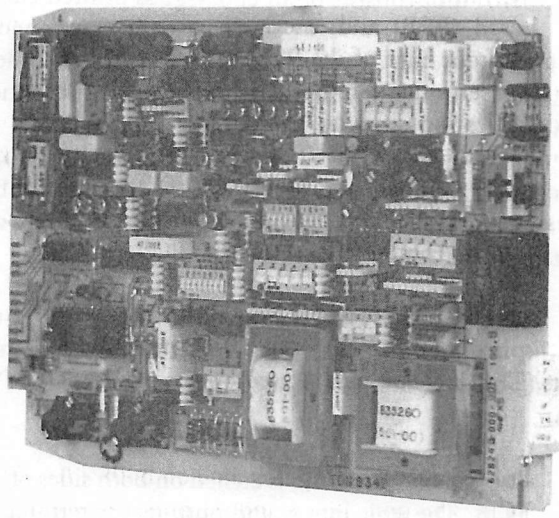


Fig. 1—4WFXS/VF Channel Unit, 628240

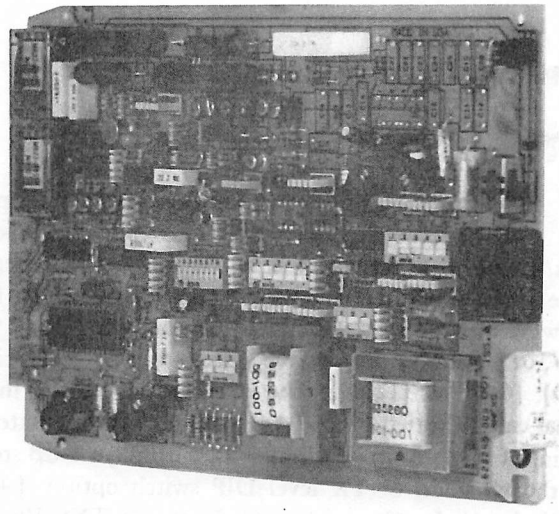


Fig. 2—4WFXS Channel Unit, 628245

1. GENERAL

1.01 This Section provides a general description of the ITT D448 4-wire foreign exchange subscriber with VF response equalizer (4WFXS/VF) channel unit, 628240 (Fig. 1), and 4-wire foreign exchange subscriber (4WFXS) channel unit, 628245 (Fig. 2), to the functional block diagram level.

1.02 Whenever this Section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The units provide a voice frequency (VF) and signaling interface between the subscriber drop and the D448 multiplex terminal common equipment. In the transmit direction, the units convert VF and signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the units decode received PCM into VF and signaling information. During system outages, the units provide various disconnect/make-busy routines for the trunk. The units provide the subscriber end of a 150-, 600-, or 1200-ohm, ground-start or loop-start foreign exchange message circuit. The far-end FXO may be either 4-wire or 2-wire.

2. DESCRIPTION

2.01 Each unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the units are provided in Section ITTR-18-441.

2.02 Each unit is available in Group -0 only.

2.03 Each unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (4WFXS/VF or 4WFXS), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The LC LED (DS1), the BSY switch (S9), the splitting card jack (J1), and the EQ OUT test points (TP1 and TP2) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 3 AND 4)

TRANSMIT VF CIRCUIT

3.01 The incoming VF is transformer-coupled, via part of the transmit (TX) level DIP switch, to the low-pass/high-pass filter where it is amplified and filtered. (The transformer has a multiple-tapped secondary that allows a 600-ohm impedance to be matched to a 150-, 600-, or 1200-ohm line by the selection of switch options [150], [600], or [1200].) The gain applied to the input signal can be varied over a 31-dB range to compensate for VF input levels from +9.0 to −22.0 dBm (in 1-dB steps) by the selection of TX level DIP switch options [+1], [+2], [+4], [+8], and [+16]. In the 4WFXS/VF, the resulting signal is fed, via a VF equalizer circuit, to the TX office wiring loss (OWL) compensation circuit; in the 4WFXS, the resulting signal is fed directly to the TX OWL compensation circuit. The equalizer circuit equalizes the effect of long loaded or nonloaded lines. The equalization may be varied by DIP switch options [L], [N]; SL [1], [2], [4], [8]; HT [1], [2], [4], [8]; and BW [1], [2], [4], [8]. TP1 and TP2 provide a monitoring point for the equalizer circuit. The resulting signal is passed to the TX OWL compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to compensate for wiring/cabling losses. The range for input levels is +9.0 to −23.5 dBm. The resulting signal is applied to the encoder.

3.02 The encoder converts the VF signal and signaling information (Para. 3.05) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

RECEIVE VF CIRCUIT

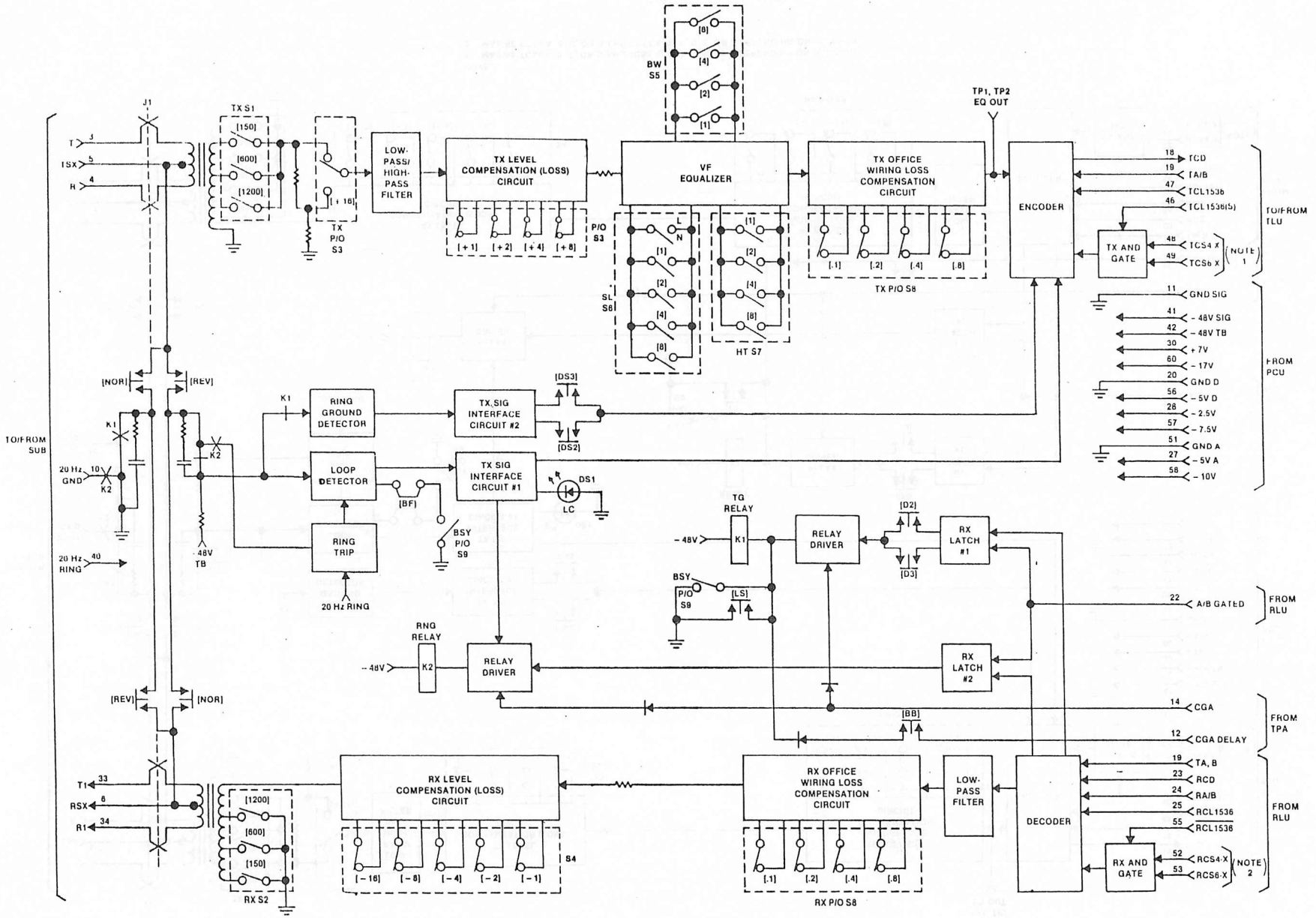
3.03 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.06).

3.04 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified. This amplification can be varied over a 31-dB range (in 1-dB increments) by the selection of RX VF level DIP switch options [−1], [−2], [−4], [−8], and [−16]. This provides output levels of +10.5 to −22.0 dBm in 0.1-dB increments with both the OWL and VF level options. The amplified VF is transformer-coupled to the subscriber drop. The transformer and DIP switch options are identical to those described in Para. 3.01.

SIGNALING

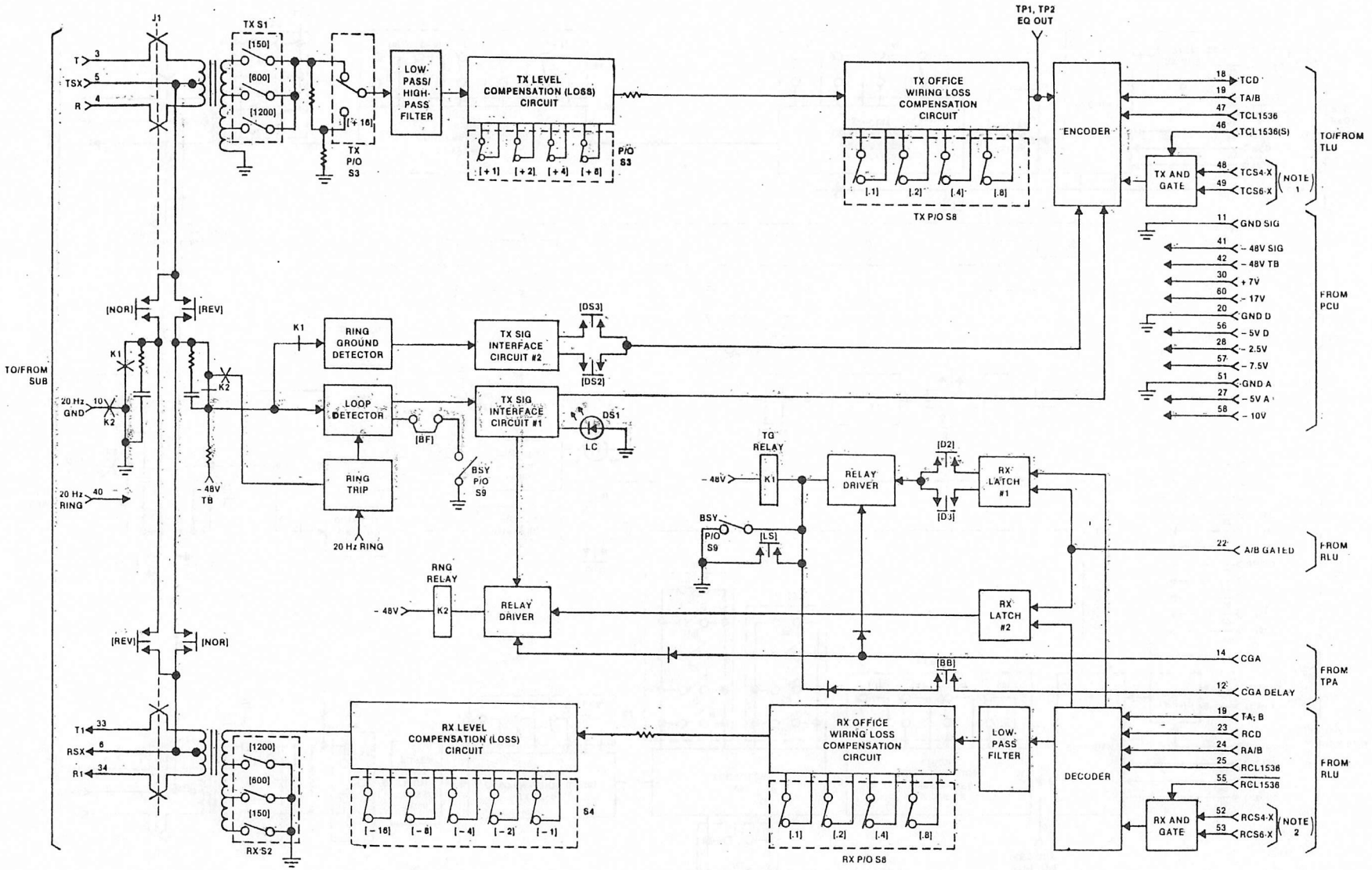
A. General

3.05 Signaling information from the subscriber to the units is via the TSX(T,R) and RSX(T1,R1) leads. The signaling information is processed via transmit signaling circuitry and the TX signaling (SIG) interface circuits. The output of the TX SIG interface circuits is applied to the encoder. However, the encoder will not process the information until it is signaled on the TA/B lead by the TLU that the signaling frame is upcoming. Each TX



NOTE:
1. MAY BE TCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.
2. MAY BE RCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.

Fig. 3—4WFXS/VF Channel Unit, 628240, Functional Block Diagram



NOTE:
1. MAY BE TCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.
2. MAY BE RCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION

Fig. 4—4WFXS Channel Unit, 628245, Functional Block Diagram

SIG interface circuit is associated with a different signaling frame.

Note: TSX is the transmit path simplex and RSX is the receive path simplex. They also refer to the simplex at the repeat coil end for the purposes of this Section.

3.06 Signaling information from the far-end foreign exchange office (FXO) channel unit is applied to the decoder along with the VF information from the far end. The decoder converts the receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to one of the RX latches. Each RX latch is associated with a different signaling frame. The RX latches and other receive signaling circuitry process the signaling information. This causes signaling conditions to be placed on the drop to the subscriber.

3.07 During intermittent terminal failures (momentary failures), the RX latches are inhibited from processing signaling information. This results in signaling state storage. This forces the unit to remain in its previous state (idle or busy) during the momentary failure to keep from dropping connections or to keep the unit from being accessed. The signaling state storage is controlled by the RLU. During a momentary failure, the RLU prevents the A/B GATED lead from making a transition which inhibits the RX latch.

B. Outgoing Call

3.08 The following paragraphs describe the signaling functions of the units when a call is being processed from the subscriber to the far-end FXO channel unit with both [NOR] option screws selected (down) and both [REV] option screws open (up). When both [REV] option screws are selected (and both [NOR] option screws are up), the TSX and RSX leads are reversed.

3.09 The unit is seized when its loop is closed by the subscriber. In ground-start operation, its R lead is grounded at the same time. In loop-start operation, a permanent ground is present on its T lead by closing option screw [LS] which energizes the TG relay.

3.10 In ground-start operation, the units do not recognize the loop closure because the T lead is open. However, the ground on the R lead is detected by the ring ground detector and sent to the far end via TX SIG interface circuit #2. Option screws [D2] and [D3] condition the signaling to be compatible with D2-type signaling or D3-/D1D-type signaling, respectively. The far-end FXO applies ring ground to the C.O. The C.O. recognizes this as a request for service from the 4WFXS/VF or 4WFXS and grounds the T lead going to the FXO. This tip ground information is sent to the 4WFXS/VF or 4WFXS. The tip ground information is applied to RX latch #1 which energizes the TG relay, causing the T lead to be grounded. This completes the loop at the drop and permits dialing to take place. Dialing occurs by pulsing of the loop at the drop. The opening and closing of the loop is detected by the loop detector which applies this information to the far end via TX SIG interface circuit #1. TX SIG interface circuit #1 turns on the LC LED when the loop is closed. The loop pulsing is sent to the far-end FXO which opens and closes its loop to recreate the dial pulsing at the drop to the C.O. At the conclusion of dialing, the talk path from the 4WFXS/VF or 4WFXS to the FXO is complete.

3.11 In loop-start operation, the T lead at the drop is permanently grounded. When the loop from the subscriber is closed, it is detected by the loop detector which applies this information to TX SIG interface circuit #1. TX SIG interface circuit #1 sends this information to the far-end FXO which consequently closes the loop to the C.O. The C.O. recognizes this as a request for service from the 4WFXS/VF or 4WFXS. Since the loops at both ends are now complete, dialing from the 4WFXS/VF or 4WFXS can now take place. Dialing occurs by pulsing of the loop at the drop. The opening and closing of the loop is detected by the loop detector which applies this information to the far end via TX SIG interface circuit #1. TX SIG interface circuit #1 turns on the LC LED when the loop is closed. The loop pulsing is sent to the far-end FXO which opens and closes its loop to recreate the dial pulsing at the drop to the C.O. At the conclusion of dialing, the talk path from the 4WFXS/VF or 4WFXS to the FXO is complete.

C. Incoming Call

3.12 The following paragraphs describe the signaling functions of the units when a call is being processed from the far-end FXO to the subscriber with both [NOR] option screws selected (down) and both [REV] option screws open (up). When both [REV] option screws are selected (and both [NOR] option screws are up), the TSX and RSX leads are reversed.

3.13 The C.O. grounds the T lead at the far-end FXO and applies ringing voltage to its tip and ring leads. In loop-start operation, a ground is permanently applied to the FXO. In either mode of operation, the FXO

sends the tip ground information to the 4WFXS/VF or 4WFXS via RX latch #1. RX latch #1 energizes the TG relay which grounds the T lead to the subscriber. This completes part of the ringing path and inhibits the 4WFXS/VF or 4WFXS from sending a ring ground signal to the far end.

3.14 The ringing voltage signal from the far end is applied to the 4WFXS/VF or 4WFXS via RX latch #2. RX latch #2 energizes the RNG relay. This causes 20-Hz negative superimposed ringing voltage to be applied on the T and R leads to the subscriber. When the loop detector senses a loop closure at the drop, it trips ringing via the ring trip circuit and applies the loop closure information to the TX SIG interface circuit #1. TX SIG interface circuit #1 turns on the LC LED and sends the loop closure information to the far end. The loop closure transmitted to the far end causes the FXO to close its loop to the C.O. This completes the talk path from the FXO to the 4WFXS/VF or 4WFXS.

CARRIER GROUP ALARM

3.15 During a system outage, two carrier group alarm (CGA) signals (CGA immediate ground and CGA delayed ground) and option screw [BB] control the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit, and the CGA DELAY lead provides a delayed ground to the unit. Both grounds remain until the CGA condition is cleared. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received.

3.16 When the CGA lead is grounded, both the TG and RNG relays are deenergized. This removes tip ground and ringing signals from the drop.

3.17 When the CGA DELAY lead is grounded, and option screw [BB] is selected, the TG relay is energized. This provides a tip ground to the subscriber.

BUSY MODE

3.18 When the BSY switch is placed in the BSY position, the TG relay is energized and ringing is inhibited. This provides a tip ground to the subscriber. If option strap [BF] is installed, a loop closure signal is forwarded to the far end via TG SIG interface circuit #1.

4. OPTIONS

4.01 The units are equipped with DIP switch options, screw-down options, and strapping options for selecting circuit options. Refer to Section ITTR-18-441 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 and 2 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
LC LED	DS1	Turns on when a loop closure is present at the 2-wire drop.
BSY Switch	S9	When placed in BSY position, provides tip ground; with option strap [BF] installed, loop closure also sent to far end.
Splitting Card Jack	J1	Provides test/break jack access to subscriber equipment and channel unit drop sides of T, R, T1, and R1 leads.
EQ OUT Test Points	TP1 and TP2	Provide test points for equalizer measurement.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage	**Current Drain (nominal)**
– 5V	25.0 mA (at 5V)
– 10V	2.0 mA (at 5V)
+ 7V	5.0 mA (at 12V)
– 17V	7.0 mA (at 12V)
– 48V SIG Battery	0 mA; 7.0 mA with option screw [LS] selected (down); 13 mA during ring interval
– 48V Talk Battery	4.0 mA plus loop current
VF PERFORMANCE	
Impedance	600 ohms balanced; 150 ohms balanced; or 1200 ohms balanced (switch selectable)
Levels	
Transmit	+ 9.0 to – 23.5 dBm, adjustable in 0.1-dB steps
Receive	+ 10.5 to – 22.0 dBm, adjustable in 0.1-dB steps
Loss Stability (End-to-End)†	± 0.5 dB over life in 95% of the circuits
Tracking (End-to-End)	
– 37 to + 3 dBm0 Input	0.5 dB maximum deviation
– 50 to – 37 dBm0 Input	1.0 dB maximum deviation
Idle Channel Noise (End-to-End)	23 dBrnc0 maximum
Signal-to-Distortion	
0 to – 30 dBm0 Input	33 dB minimum overall; 35 dB minimum receive or transmit
– 40 dBm0 Input	27 dB minimum overall; 29 dB minimum receive or transmit (deviation to 1 dBrnC for – 21 dBm TLP)
– 45 dBm0 Input	22 dB minimum overall; 25 dB minimum receive or transmit (deviation to 1 dBrnC for – 20 dBm TLP)

TABLE B (CONT)

ITEM	SPECIFICATION
Single Frequency Distortion (at 0 dBm0)	
Input Swept from 0 to 12 kHz	– 28 dBm0 maximum at any other frequency
Input between 1004 and 1020 Hz	– 40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better
Return Loss	
600 ohms	
1000 Hz	28 dB minimum
300 to 3000 Hz	23 dB minimum
150 or 1200 ohms	
1000 Hz	23 dB minimum
300 to 3000 Hz	20 dB minimum
Frequency Response (Referenced to 1020 Hz, End-to-End)†	
200 Hz	0, – 3.0 dB
300 to 3000 Hz	± 0.3 dB
3200 Hz	+ 0.15, – 1.5 dB
3400 Hz	0, – 3.0 dB
Longitudinal Balance (AT&T or IEEE Method)	
200 Hz	66 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
†600-ohm setting	
SIGNALING	
Pulsing Distortion	
Input (at FXS)	Loop pulsing at 12 pps, 64% break, with 1500 ohms external circuit resistance
Output (at FXO)	69% break maximum direct; 71% break maximum at A relay output
Input (at FXS)	Loop pulsing at 12 pps, 58% break, 4 C4A ringers, and 15 k ohms leak resistance
Output (at FXO)	43% break minimum

TABLE B (CONT)

ITEM	SPECIFICATION
Loop Range	0 to 1900 ohms
Tip Ground Disconnect Delay	125 to 300 msec
OPERATING ENVIRONMENT	
Temperature	0 to +55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Width	0.8 in. (1.9 cm)
Height	5.9 in. (15.0 cm)
Depth	9.7 in. (24.6 cm)
WEIGHT	1.2 lb (0.5 kg)

8. REPLACEABLE PARTS

8.01 These units have no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly	628240-000
Schematic	628240-002
Assembly	628245-000
Schematic	628245-002

9.02 Related information on the units may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Special Service Channel Units — Option Selection and Installation	ITTR-18-441